Claims

1. A method of determining, in a predefined target position, the sound pressure (Δp) resulting from sound emitted from a surface element (ΔS) of a sound emitting surface (S), the method comprising

- measuring, using a three-dimensional array of a plurality of microphones arranged in a first predefined measuring position relative to the surface element (ΔS), a first three-dimensional distribution of sound pressure,

- calculating, based on the first three-dimensional distribution of sound pressure, the air-particle velocity (u_n) on the surface element (ΔS) and perpendicular to the surface element (ΔS), resulting from the sound emitted from the surface (S),

- arranging a sound source capable of emitting a volume velocity (Q_v) in the target position,

- causing the sound source to emit the volume velocity (Q_v),

- measuring, using a three-dimensional array of a plurality of microphones arranged in a second predefined measuring position relative to the surface element (ΔS) and with the volume velocity (Q_v) emitted from the sound source in the target position creating a dominating sound, a second three-dimensional distribution of sound pressure,

- calculating, based on the second three-dimensional distribution of sound pressure, the sound pressure (p_V) at the surface element (ΔS) resulting from the volume velocity (Q_v) emitted from the sound source in the target position,

- determining the transfer function $H = p_v/Q_v$ as the ratio of the sound pressure (p_v) at the surface element (ΔS) to the volume velocity (Q_v) emitted from the sound source in the target position, and

- determining the sound pressure (Δp) in the target position as $\Delta p = H \cdot (u_n \cdot \Delta S)$.

2. A method of determining, in a predefined target position, the sound pressure (Δp) resulting from sound emitted from a surface element (ΔS) of a sound emitting surface (S), the method comprising

- measuring, using a three-dimensional array of a plurality of microphones arranged in a first predefined measuring position relative to the surface element (ΔS), a first three-dimensional distribution of sound pressure,

- calculating, based on the first three-dimensional distribution of sound pressure, the air-particle velocity (u_n) perpendicular to the surface element (ΔS) and on the surface element (ΔS), and the sound pressure (p) on the surface element (ΔS), resulting from the sound emitted from the surface (S),

- arranging a sound source capable of emitting a volume velocity (Q_v) in the target position,

- causing the sound source to emit the volume velocity (Q_v),

- measuring, using a three-dimensional array of a plurality of microphones arranged in a second predefined measuring position relative to the surface element (ΔS) and with the volume velocity (Q_v) emitted from the sound source in the target position creating a dominating sound, a second three-dimensional distribution of sound pressure,

- calculating, based on the second three-dimensional distribution of sound pressure, the sound pressure (p_V) at the surface element (ΔS) and the component of the particle velocity ($u_{V,n}$) perpendicular to the surface element (ΔS) resulting from the volume velocity (Q_v) emitted from the sound source in the target position, and

- determining the sound pressure (Δp) in the target position in accordance with the formula

$$\Delta p = \iint_{\Delta S} \left[\frac{p_V}{Q_V} u_n - \frac{u_{V,n}}{Q_V} p \right] dS .$$

3. A method according to any one of claims 1-2 c h a r a c t e r i z e d in that the target position is a listening position suitable for being occupied by a human being.

4. A method according to claim 1 c h a r a c t e r i z e d in that the air-particle velocity (u_n) perpendicular to the surface element (ΔS) resulting from the sound emitted from the surface (S) is calculated, based on the first three-dimensional distribution of sound pressure, using a Near-Field Acoustical Holography (NAH) method, and that

the sound pressure (p_V) at the surface element (ΔS) resulting from the volume velocity (Q_v) emitted from the sound source in the target position is calculated, based on the second three-dimensional distribution of sound pressure, using a Near-Field Acoustical Holography (NAH) method.

5. A method according to claim 2 c h a r a c t e r i z e d in that the air-particle velocity (u_n) perpendicular to the surface element (ΔS) and the sound pressure (p) resulting from the sound emitted from the surface (S) are calculated, based on the first three-dimensional distribution of sound pressure, using a Near-Field Acoustical Holography (NAH) method, and that

the sound pressure (p_V) at the surface element (ΔS) and the air-particle velocity ($u_{V,n}$) perpendicular to the surface element ΔS resulting from the volume velocity (Q_v) emitted from the sound source in the target position are calculated, based on the second three-dimensional distribution of sound pressure, using a Near-Field Acoustical Holography (NAH) method.

6. A method according to any one of claims 1-5 characterized by using as the volume velocity sound source a simulator simulating acoustic properties of at least a head of a human being, the simulator having a simulated ear with an orifice and a sound source for outputting sound signals through the orifice of the simulated ear.

7. A method according to claim 6 characterized in that the simulator simulates the acoustic properties of the head and a torso of a human being.

8. A method according to any one of claims 1-7 characterized by using, as the three-dimensional array of a plurality of microphones, an array having two parallel layers of microphones, where each layer comprises a plurality of microphones arranged in a two-dimensional grid.

9. A method according to any one of claims 1- characterized by using, as the three-dimensional array of a plurality of microphones, an array comprising a combination of pressure microphones and particle velocity sensors.

10. A method according to claim 9 characterized by using, as the three-dimensional array of a plurality of microphones and velocity sensors, a planar array of combination sensors, each being able to measure both the sound pressure and the particle velocity component perpendicular to the array plane.

11. A method according to claim 2 characterized in that the sound pressure (Δp) in the target position is determined as an approximation in accordance with the formula

$$\Delta p = \left[\frac{p_V}{Q_V} u_n - \frac{u_{V,n}}{Q_V} p \right] \Delta S \, .$$